



Annual Report

The State of STEM Education in Delaware

April 2012

Science | Technology | Engineering | Mathematics

From the Governor

Last January, I signed Executive Order number 15, an act that officially created the Delaware STEM (Science, Technology, Engineering and Mathematics) Council. In the simplest of terms, the Council was created to evaluate the state of STEM education in our state and find ways to improve it. Our goal is to increase the STEM literacy and skills of *all* Delaware students, thereby increasing our STEM-capable workforce which we believe will create, grow and attract STEM-related businesses to Delaware.

The STEM Council is composed of 26 highly qualified and talented individuals from every corner of the State -- a combination of educators, school administrators, technology employers, government officials, and students. Judson Wagner, STEM Coordinator for the Brandywine School District, and former U.S. Senator Ted Kaufman - himself an engineer - serve as Co-Chairs of the Council.

This past year, these men and women have undertaken a very difficult assignment, bringing focus to an area that is critical to ensuring that our students graduate ready to compete in a global marketplace. Consider this: U.S. student achievement in mathematics and science is lagging behind students in much of Asia and Europe. The 2010 ACT College and Career Readiness report found that only 29% of the tested 2010 graduates are considered college-ready in science and only 43% are considered college-ready in math.

Some may still be skeptical about the need to concentrate our efforts and resources on what many believe to be a select few disciplines. Let me assure you that STEM subjects span an incredible number of careers, including traditional fields such as agriculture, medicine, engineering and economics, and many that we haven't yet imagined. A STEM education also develops skill sets such as communication and critical thinking. Like STEM knowledge, these skills are highly transferable to a wide range of occupations. By 2018 for example, nearly 1 in 4 Delaware occupations will require significant science skills. Likewise, math skills and critical thinking skills will be important to 81% and 96% of Delaware occupations respectively.

According to the U.S. Commerce Department, STEM occupations are expected to double in growth in comparison to non-STEM occupations by 2018. We owe each of our students a strong foundation in STEM to empower them to innovate and compete. I am confident that the work of the STEM Council will help us to develop that foundation.

On behalf of all Delawareans, I'd like to thank Senator Kaufman, Judson Wagner, and all of the STEM Council members for their tireless work and unique contributions. Their hard work is represented in this report. Many of their findings and recommendations are not one-time, quick fixes. In order to truly affect the type of changes we envision, it will take a steady and sustained effort over many years. Rest assured, we are committed to seizing this opportunity. We stand ready to arm our kids with the critical skills and knowledge they need to excel.



Governor Jack Markell



W H A T
is
S T E M
education
&
how does it
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STEM Education

STEM Education is an approach to teaching and learning that emphasizes integration of science, technology, engineering, and mathematics for all students through student-focused, problem-based curricula and instruction. STEM education fosters creativity and innovation while developing communication, collaboration, and critical thinking skills through a focus on authentic and appropriate contexts in curriculum and assessment.

Delaware STEM Council Vision

Delaware will be a leader in STEM education where students are prepared and inspired to use innovation and creative problem solving to excel in the global society.

Delaware STEM Council Mission

Working with educators, legislators and business and community leaders, the Council will foster Science, Technology, Engineering and Mathematics (STEM) education in Delaware to prepare students for careers of the 21st century which meet competitive challenges by fueling innovation and stimulating economic growth.

Delaware STEM Council Goals

- 1) Expand the number of Delaware students who ultimately pursue advanced degrees and careers in STEM fields and broaden the participation of women and minorities in these fields.
- 2) Expand the STEM capable workforce to create, grow and attract STEM related businesses to Delaware.
- 3) Increase STEM literacy for all Delaware students including those who pursue non-STEM related careers, but need STEM skills.



Our Philosophy

It is essential to fully understand and address the challenges in *each* area if we are to prepare our children for success.

In the same vein, if our workforce is educated and well-prepared, we will certainly attract business to Delaware.

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STEM Council Report

In years past, conventional wisdom was that an intense focus on increasing a select group of student aptitudes in the areas of science, technology, engineering and mathematics was a laudable concept with practical implications for very specific, specialized businesses. STEM, we used to believe, was of minor concern to the majority of students and of little import to the collective business community and local economy.

Today, we have clearly seen the error in that thinking.

What is at stake here is literally the future prosperity of Delaware and Delaware's citizens. The Delaware STEM Council believes that the development of a robust and centrally organized Pre-Kindergarten-to-career alignment of STEM programs is imperative to the economic vitality of our state.

These efforts are critical not just for those who major in STEM disciplines, but for the many more who do not, but who still require solid STEM skills to be successful in the 21st Century workplace. Research shows that companies of the future in Delaware, across the nation, and throughout the world, will require proficiency in STEM subjects. Delaware is well positioned to be a leader in STEM education and to attract successful STEM businesses. But, in order for this to become a reality, much work needs to be done.

The first Annual Report of the Delaware STEM Council explores the state of STEM education in Delaware – its strengths, weaknesses, and opportunities for improvement. We view the work of this Council through the prism of three separate, but equally important, components to a thriving STEM system: PK-12 Education; Higher Education; and the Business Community. A solid STEM foundation in primary and secondary schools, coupled with stellar higher education STEM integration, greatly increases one's chances of obtaining and maintaining a satisfying and high paying STEM career. A pipeline of highly STEM knowledgeable people will in turn attract dynamic and growing businesses to Delaware.

The work of the Council is divided among six committees with specific areas of concern and unique challenges: Advisory; Public Education; Women and Minorities; Higher Education; Business Collaboration and Communication; and Program Evaluation & Monitoring. Their research and analyses weave together a picture of where we currently stand, and their recommendations will point us to where we are going.

(Committee reports are available in their entirety at www.stem.delaware.gov)



The acronym STEM - Science, Technology, Engineering, and Mathematics - was originally coined to draw attention to fields of study that addressed the needs of occupations that were not being filled by students emerging from the American public school system. STEM literacy has further developed to include skills such as creative and analytical thinking, collaborative problem solving, and effective written and oral communication - all of which are equally relevant to non-STEM occupations. From early childhood through college, STEM literacy is designed to encourage curiosity, imagination and entrepreneurship.

Over the course of 2011, we found that there are numerous efforts to provide quality STEM opportunities for students in Delaware. Those efforts, however, are neither consistent across the state, nor are they fully vertically integrated, such that the needs of the workforce are working to inform the higher education and PK-12 system.



U.S. Senator Ted Kaufman STEM Council Co-Chair

Ted Kaufman is a former U.S. Senator from Delaware who served on the Foreign Relations, Armed Services, Judiciary, and Homeland Security Committees.

He was the only Senator to have worked as an engineer and promoted the expansion of STEM education. He secured \$400,000 to fund research and extension grants for women and minorities in STEM, and authored the STEM Education Coordination Act which requires overall coordination of all federal programs and activities in support of STEM education.

Ted received the American Society of Mechanical Engineering's prestigious President's Award; Duke University Engineering School's Distinguished Alumni award; and Delaware Bioscience's Government Official award. He was the keynote speaker at the convocations of the University of Delaware and University of Pennsylvania Engineering Schools, and the annual national meeting of the Engineering Deans Institute.



Judson Wagner STEM Council Co-Chair

Jud Wagner is the STEM Coordinator for the Brandywine School District. Prior to that position, he was a physics teacher for 15 years at Concord High School, as well as Department Chair.

He earned his B.S. in Physics from Elizabethtown College and his M.Ed. in Instructional Technology from Wilmington College. He is a National Board Certified Teacher (NBCT) and Co-Chair of the Delaware Stem Council.

As an educator, he has been recognized with the Presidential Award for Excellence in Math and Science Teaching (PAEMST); the Siemen's Advanced Placement Award for Teaching; and the Cable Industry's Leader in Learning Award.

While national projections show that STEM occupations will represent the greatest growth in the next decade, our country is falling far behind in the foundational skills necessary to prepare students for the rigors of basic high school and college level coursework. According to the National Assessment of Educational Progress (NAEP) in 2009, only 34% of U.S. 8th graders were rated proficient or higher on the national math assessment, and more than 1 in 4 scored below the basic level.

Similarly, according to PISA (Programme for International Student Assessment), an international exam given to 15 year olds every three years, U.S. students ranked behind 12 industrialized nations in science, and 17 in math in 2009. As a consequence to the nation's trajectory, there will be an estimated shortage of 3 million workers with U.S. college degrees by 2018.

In Delaware, 2011 NAEP results show that 8th graders ranked 31st in the country with only 34% scoring proficient or higher in math, and 4th graders ranked 29th in the country with 39% scoring proficient or higher.

In conjunction with these statistics, we used the Advanced Placement (AP) Summary Reports from the College Board to look at participation in and successful passage of AP exams to provide a common statewide measure of student readiness for STEM coursework at the higher education level. Delaware's participation

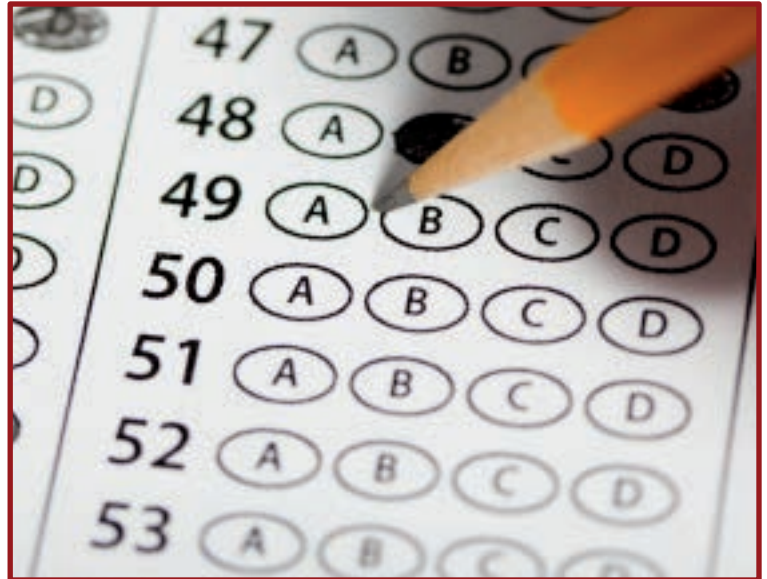
rate is low, with one AP exam taken for every 73 Delaware public school students, compared to the region's leader, Maryland, with one AP exam taken for every 43 Maryland public school students, a difference of 69%. In 2011, Delaware ranked last in the region in AP passage rates, with only 42% of the students who took an AP STEM exam passing. (AP STEM numbers include Biology, Chemistry, Physics B, Physics C-Mechanics, Physics C-Engineering and Mathematics, Calculus AB, Calculus BC, and Computer Science.)

Drilling those numbers down even further, the statistics regarding women and minorities participation in STEM AP courses are even more troubling. While the overall AP STEM passage rate in Delaware is 42% as noted above, the passage rates for female students is lower at 40%, and that of African American students is far lower, at 19%, representing the lowest rates in the region. PSAT data taken in 11th grade points to far fewer female students being interested in STEM pathways before an AP course is even offered. (Our Women and Minorities Committee has thoroughly explored these challenges in their report, a synopsis of which appears later).

Low AP STEM exam rates translate into high rates of attrition of STEM majors in college, including Delaware's Institutes of Higher Education. STEM majors usually call for additional lab time and the required courses are often strictly sequential, leaving little room to fall behind. The results of this are clear: only 31% of U.S. degrees in 2008 were earned in Science and Engineering compared to 38% in Canada, 35% in Mexico, 51% in China and 61% in Japan. (Nation Science Board S&E Indicators 2012) Furthermore, in Delaware, the courses needed to succeed in a STEM post-secondary major have not been clearly defined within or among the higher education institutes. To address the full pipeline of STEM needs, students must have this information available to them at the secondary level.

Delaware needs content-trained STEM teachers, particularly in engineering and technology education. The teacher pipeline necessary to prepare and support students through a STEM focused education has not yet been fully developed. Most of Delaware's current engineering and technology teachers have either come from industry or have gone through programs in schools in neighboring states including: The College of New Jersey, Millersville University, and University of Maryland Eastern Shore. (Our Higher Education Committee has researched ways and alternative routes to better prepare future teachers, as well as to delineate clear and concise requirements for students looking to enter STEM majors.)

When viewed through the 3-way prism we have adopted, the PK-12 and higher education challenges we are facing directly correlate to issues we will face in both fulfilling the needs and maximizing the potential of our business community. Though the outlook for STEM-related jobs required by Delaware businesses is promising in the near term, if Delaware does not build a STEM education system that can compete with its regional neighbors, the economic consequences will be significant. Delaware businesses need to be assured that there is a local pipeline that produces qualified and capable STEM professionals, as well as a STEM capable workforce.



“In 2010, there were 7.6 million STEM workers in the United States, representing about 1 in 18 workers. STEM occupations are projected to grow by 17% from 2008 to 2018, compared to 9.8% growth for non-STEM occupations. STEM workers command higher wages, earning 26% more than their non-STEM counterparts. More than two-thirds of STEM workers have at least a college degree, compared to less than one-third of non-STEM workers. STEM degree holders enjoy higher earnings, regardless of whether they work in STEM or non-STEM occupations.”

STEM: Good Jobs Now and for the Future, U.S. Department of Commerce, July 2011

This is not to say, however, that there is not a wide range of STEM initiatives taking place in Delaware. Several Delaware districts and schools have begun implementing STEM programs, including developing STEM emphases, implementing STEM academies and creating their own local STEM business networks.

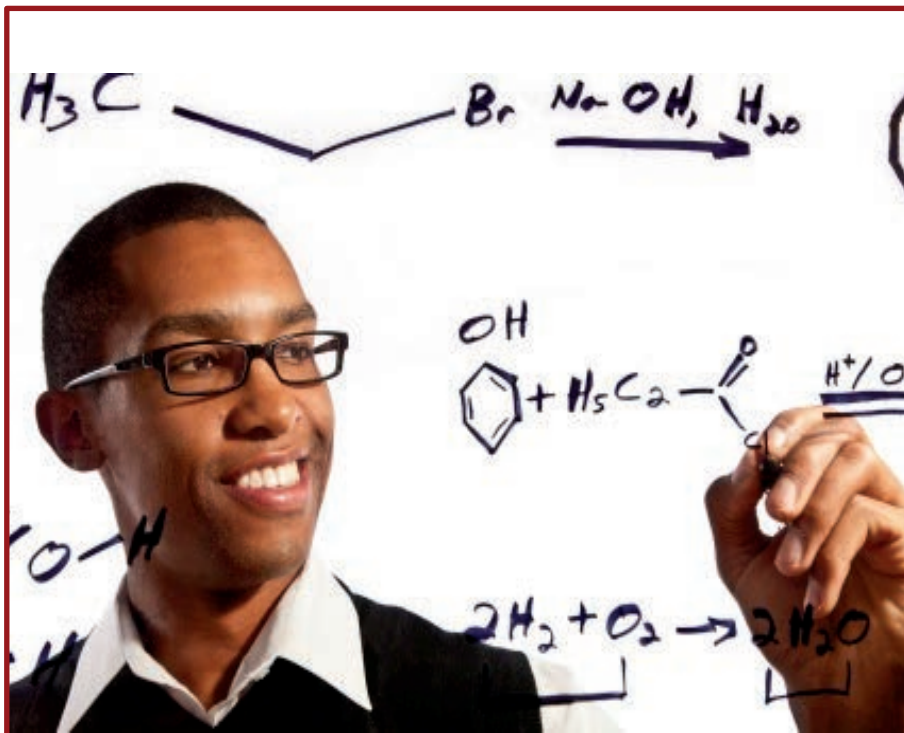
Districts and schools also offer varying levels of AP

coursework in STEM subjects, and numerous career and technical STEM education pathways exist. At the elementary level, Delaware’s Science Coalition recently adopted two engineering programs that will be available statewide. In addition, some schools and districts participate in collaborative STEM-related competitions such as Lego League, Odyssey of the Mind and Technology Student Association (TSA) programs and events.

Teachers can now benefit from the AP Summer Institute that is offered by the Department of Education to better prepare them to teach AP courses. Also this summer, professional STEM training will be offered to educators at the Delaware STEM Institute.

While all encouraging, these endeavors are not part of a coordinated statewide effort that makes quality STEM opportunities consistently available to students. (Our Public Education, Program Evaluation, and Advisory Committees deal with the challenges inherent in our system, and offer very specific suggestions for addressing them).

Despite our disparate efforts and test data, however, Delaware is fertile ground when it comes to economic development around STEM related businesses and industries. As the home of companies such as DuPont, Gore and AstraZeneca, Delaware has a history rich with innovation, scientific advancement and enduring partnerships with the education system. The business friendly laws and regulations that exist also make Delaware attractive to STEM-related business.



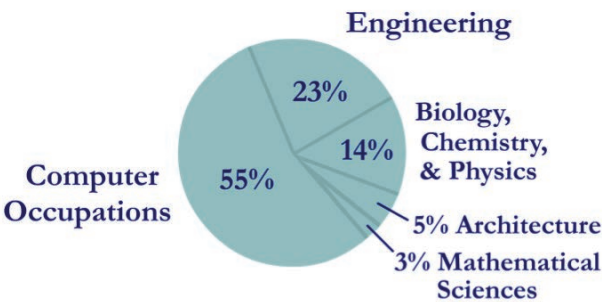
With these two foundational pieces, Delaware's workforce percentage in Science and Engineering ranked 10th nationally ahead of New Jersey, Pennsylvania, and New York. As a way of gauging the amount of innovation and discovery occurring in our state, the concentration of patents awarded to Scientists and Engineers ranked 17th nationally in 2010, putting us ahead of New York, Pennsylvania, and Maryland. Even more impressive is the percentage of High Tech businesses to all businesses - Delaware ranked first as a state in the nation in 2008. (Nation Science Board S&E Indicators 2012)

The outlook for the STEM-related jobs required by Delaware businesses is promising for the near future. By 2018, STEM occupations will make up 1 in every 12 Delaware occupations. Within these STEM occupations, 14% will be Biologists, Chemists, and Physicists, 23% will be Engineers and Engineer Technicians, and 55% will be in Computer occupations. According to O*Net (Occupational Information Network sponsored by the U.S.

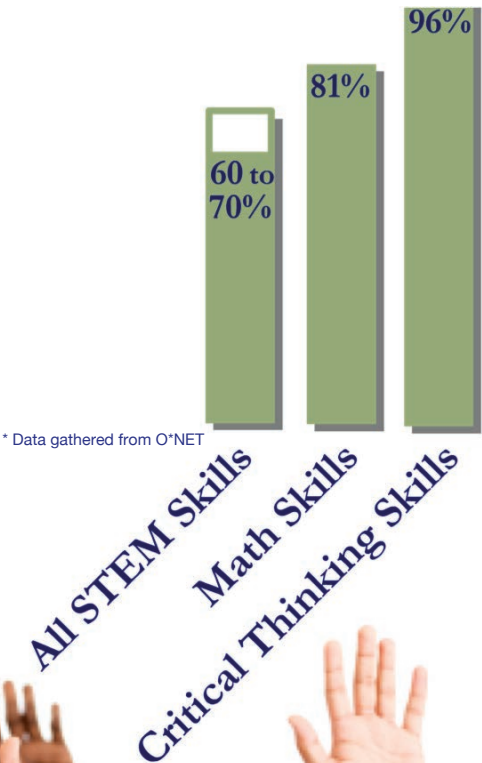
Department of Labor) and Delaware's Occupation and Industry Projections, this knowledge base in computers will be important to 54% of all Delaware occupations, and very important to 38% by 2018.

A STEM education also develops skill sets which are highly transferable to a wide range of occupations. By 2018, nearly 1 in 4 Delaware occupations will require significant science skills. Likewise, math skills and critical thinking skills that are part of a STEM education will be important to 81% and 96% of Delaware occupations respectively.

The high demand for STEM jobs versus the data we see from AP results as well as NAEP in grade school math, raises clear and crucial questions regarding the supply of prepared students coming through our system of education. The Council's role in facilitating a cohesive and productive delivery and support system of STEM skills in Delaware has become at once more defined and more relevant.



*Data gathered from the Georgetown University Center on Education and the Workforce



* Data gathered from O*NET

Executive Committee

Ted Kaufman, Former U.S. Senator & STEM Council Co-Chair

Judson Wagner, STEM Coordinator Brandywine School District & STEM Council Co-Chair

Dan Cruce, Esq., Deputy Secretary of Education and DOE Chief of Staff

Jennifer Ranji, Esq., Education Policy Advisor, Office of the Governor

Margaret Aitken, Media and Communication Specialist

Laurisa Schutt, Program and Administrative Coordinator, DE STEM Council

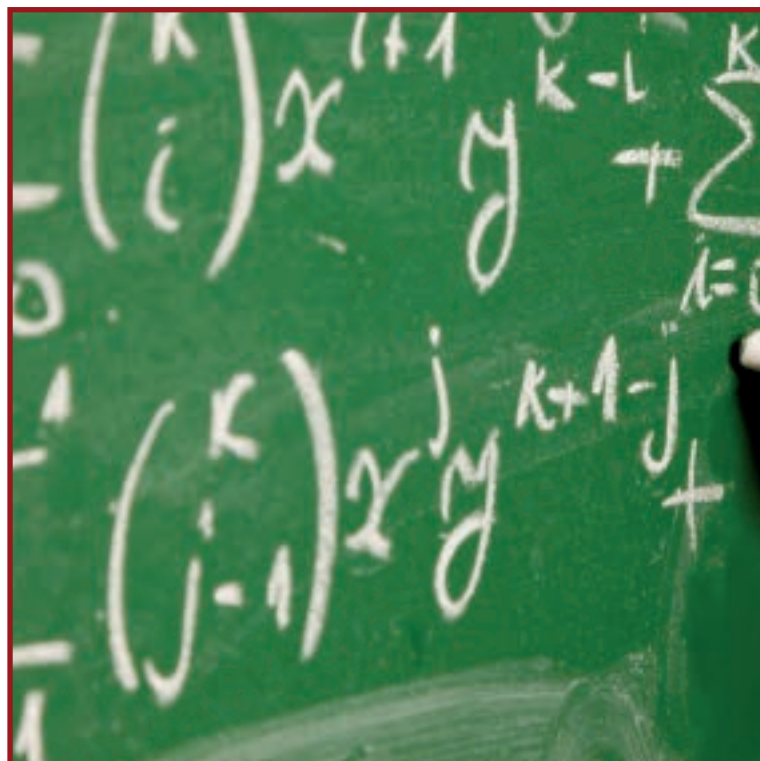
Council Activities & Recommendations

A highlight of the Council's recommendations broken down by area follows. The committee reports appear in greater detail with additional recommendations later in this report and can be read in entirety on the Council's web page www.stem.delaware.gov.

PK - 12

While the focus on STEM in many of our schools and districts is apparent from the courses and programs offered, Delaware lacks a centralized means of identifying, communicating, and collaborating to leverage STEM opportunities. Providing a mechanism for regular communication with and among the school districts and charter schools regarding STEM initiatives is critical. The Council has taken, and will take a number of steps to address that need.

First, the Council's Business Collaboration and Communication Committee has created a STEM website, found at www.stem.delaware.gov. The website will provide STEM-related information to assist schools, districts, and others who wish to learn about or become involved with STEM opportunities. As the remaining recommendations indicate, the website will provide a clearinghouse of information regarding STEM programs, evaluation tools, events, funding opportunities, and other information.



While the creation of a website will assist with STEM communications, a more targeted approach will reach further into the districts and charter schools. The Public Education Committee has therefore identified a STEM contact within each district and charter school to disseminate information regarding STEM funding opportunities, professional development opportunities, and other STEM initiatives. In addition, the Committee will convene quarterly roundtable discussions with the district and charter contacts to provide important opportunities to begin regular dialogue and sharing of information and best practices.

With communications structures in place, the Council will focus significant attention on the collection, development and analysis of STEM-related information that will be beneficial to educators, schools, and districts.

Delaware lacks an inventory of the various STEM offerings currently in use, and equally important, a means of evaluating which of those programs is effective. Having an inventory of STEM offerings would help to identify the gaps that exist and would also be a resource for districts or schools that are considering increasing their STEM offerings, but do not know what is available. The Council's Program Evaluation and Monitoring Committee has therefore created, and will continue to update, an inventory of STEM programs that occur within classroom hours. The Advisory Committee is likewise working on an inventory of STEM programs outside of classroom hours. The information in the inventory, which will be available on the STEM website, has been developed from a survey of all districts and charter schools as well as other data gathering.

Learning which initiatives impact student outcomes is critical to ensuring that limited time and resources are devoted to the efforts most beneficial to students. Therefore, in addition to creating the inventory to assist schools and districts considering adopting or expanding their STEM offerings, the Program Evaluation and Monitoring Committee has begun the work of researching methods used by other states to evaluate the effectiveness of STEM programs and will use that information to evaluate – or to assist schools, districts, and others in evaluating – their own STEM programs.

Increasing the participation of women and underrepresented minority groups in STEM education and careers is also of concern and must be addressed. The Women and Minorities Committee will take a number of steps to address this area. One key initiative is the establishment of a cadre of women and minority STEM mentors for students beginning at the elementary level. Providing a STEM role model for students at an early age will encourage students to see STEM careers as attainable options, and will hopefully avoid the erection of some of the barriers that lead to the disparities in the representation of these groups in STEM fields.

Lack of sufficient funding is a clear barrier to more STEM opportunities for students. While some funding is available from various sources, the ability of schools and districts to find such funding sources is limited and varied. The Advisory Committee will research funding available from federal, state, and private sector sources, and make that information available on the STEM website.



Understanding the need for an integrated and comprehensive system, the Council recommends an in-depth review of PK-12 STEM course offerings to identify areas lacking in STEM opportunities. The Council completed an initial survey of STEM courses, pathways, and programs, and will be issuing a more detailed follow-up survey. We know, for example, that Computer/Informational Science will be the largest sector of Delaware STEM occupations by 2018. When looking at AP Computer Science results, however, only 29 Delaware public school students sat for the Exam in 2011 (comparatively, 572 students sat for the AP Calculus exam). Of those 29, only three AP Computer Science students were female and none were African American. If we are to meet the projected workforce needs, we will need to significantly increase our computer science offerings.

Finally, given the heightened focus on STEM in Delaware, the Council recommends that the Department of Education create a position that would coordinate STEM work statewide and provide a common contact for districts and charter schools to aid program development.

Business

The link between STEM skills being taught in our schools and STEM needs of the private sector must be more integrated if today's STEM learning opportunities will truly meet the needs of tomorrow's career opportunities.

The private sector has much to offer and much to gain from working with the PK-12 system to support STEM learning.

The Business Collaboration and Communication Committee has researched other states' efforts, and has found a number of ways that the private sector can support STEM learning in the classroom. To focus and strengthen this critical link, the Council will establish a Delaware STEM Business Network comprised of STEM business representatives from across the State. The Business Network will conduct a survey of Delaware businesses to determine their STEM skill requirements. The Network will also consider ways in which private sector entities may assist in the PK-12 system. Based on other states' experiences, the Business Network will consider initiatives such as connecting STEM professionals to schools that seek speakers or co-teachers, and offering internship opportunities to students and teachers.

In addition, the Network will work with the Council to establish a STEM grants and awards program. The program will recognize outstanding work by STEM mentors and business supporters and will raise funds for Delaware STEM programs.

Higher Education

The Council found a surprising lack of communication regarding STEM education between the higher education institutes and the PK-12 system. In particular, basic information regarding the coursework that is necessary for a student to be prepared to pursue a post-secondary STEM degree is not currently available. The Higher Education Committee has been working with the higher education institutes to establish basic standards that a student must meet in order to succeed in a STEM major in one of Delaware's colleges or universities. The Committee will provide the information to the PK-12 system this spring. Once the requirements have been established, the coursework will be back-mapped through the PK-12 system.

The ability of students to see meaningful, real world outcomes of STEM work is critical to their willingness to prepare for and commit to STEM majors. Our colleges and universities provide a place for students to experience the types of experimentation and research that is possible with STEM knowledge. The Higher Education Committee will also work with the higher education institutions to establish mentoring and/or internship opportunities for their students.



Committee Reports

Committee Members

George Reissig, President and Founder of Pixstar, Inc.

Dave Cadogan, Engineering Manager, ILC Dover

Adjunct Members

Anshu Dixit, Cindy Hall, Portia Yarborough

Business Collaboration & Communication

Committee Objectives

Develop, implement and maintain a Communication & Collaboration Plan for the DE STEM Council; Facilitate the creation of an independent DE STEM Business Network.

Report Highlights & Recommendations

In 2011, the Committee focused on research and planning as well as establishing internal Council communications tools. Our plans for 2012 include actions that will meld the external communications of the Committee with business collaboration goals. These plans include: creating communications branding, planning public speaking events for state leadership with media coverage, creating a Delaware STEM website, and establishing a STEM Business Network.

In 2012, the Business Committee will:

- Develop a Communication Plan for the STEM Council to include various tools such as the Delaware STEM website as a focal point of communication.
- Draft a charter and mission statement for the Delaware STEM Business Network and work with the Executive Committee to recruit the founding members.
- Support the Business Network in many areas including: the development of a common agenda to promote network behavior, and the creation of tactics to promote the importance and bipartisan nature of STEM education to lawmakers and other stakeholders. Key messaging will include the belief that STEM skills and careers provide economic innovation, business development, jobs, and work force equality.

All Committee reports are available in their entirety at www.stem.delaware.gov



Women & Minorities

Committee Objectives

Study the demographic distribution of students taking STEM education programs or choosing STEM career pathways, including the representation of women and minorities; Develop strategies to address disparities, and promote STEM education and careers in high-needs, high-minority or low-performing school environments.

Report Highlights & Recommendations

In 2011, the Committee found that, regardless of background, students are not choosing STEM classes, majors of study, or careers in the numbers necessary to fill Delaware's job needs. Because the job skills data emphasizes critical thinking, the data also indicates that learning the STEM skill set begins in early childhood. The lack of women and underrepresented minorities in STEM fields is even greater than in the general population.



In 2012, the Women and Minorities Committee will:

- Work with other Committees and the DOE to increase professional development for all school personnel that focuses on incorporating spatial skill instruction for students, combating negative stereotypes about women and minorities in STEM, and showing students that by pursuing STEM careers they can make a positive difference in the community.
- Create a STEM Speakers Bureau to connect students to STEM role models.
- Tap into existing parent and community outreach programs to inform families about STEM opportunities and initiatives and to help families and teachers work together to create a STEM education support zone "STEMEDZ" tailored to the needs of each school community.

Public Education

Committee Objectives

Work with district and charter schools to incorporate proven STEM instruction programs that offer a rigorous course of study into their curricula; Work with the DOE, school districts, and charter schools on strategies to increase the number of students who are college or career ready in STEM fields; Meet with educators and school leaders to review and improve professional development in STEM areas and STEM alternative certification programs, as well as to promote the state-wide use of effective programs.

Report Highlights & Recommendations

In 2011, the Committee assisted in developing a baseline survey of PK-12 STEM offerings statewide. Results of the survey are being used to form the basis of an inventory of STEM programs, courses and pathways in Delaware.

In 2012, the Public Education Committee will:

- Develop and maintain a list of STEM contacts within districts and charter schools to provide regular communication regarding funding opportunities, evaluation tools and professional development related to STEM initiatives.
- Plan quarterly roundtable discussions with STEM contacts to identify ways in which the sharing of best practices for STEM programs can occur.
- Assist with the creation of the next STEM survey to gather more detailed information regarding STEM courses and programs in Delaware schools.
- Implement programming and professional development that can be embedded within the current curriculum, thereby increasing STEM awareness, and quality opportunities throughout all grade levels.

Committee Reports

Committee Members

Cheryl Potocki, Teacher at the Charter School of Wilmington

Randolph Guschl, Director of the Center for Collaborative Research and Education, Dupont

James H. Sills III, Secretary of the Delaware Department of Information Technology

Adjunct Members

Donald L. Baker II, Melany Hoffman, Tonyea Mead, David Stover

Committee Members

Andrea Connally, Science Department Chair at the Alfred G. Waters Middle School

Pratyusha Gupta, Student at Caesar Rodney High School

Diana Roscoe, K-12 Math Specialist for the Southern DE Professional Development Center

John Singer, STEM Instructor for the Brandywine School District

Steven Vanderloo, Student at Concord High School

Adjunct Member

John Moyer

Committee Reports

Committee Members

Donna Johnson, Executive
Director of the Delaware State
Board of Education

Susan Bunting, Superintendent of
Indian River School District

Renee Parsley, Math Content
Specialist, Sussex Technical High
School

Adjunct Members
Randy Guschl, Marian Wolak,
Stephanie Wright

Advisory Committee

Committee Objectives

Recommend ways the Delaware Department of Education can promote district STEM initiatives based on a repository of research from all committees; Work with the Department of Education to recommend material to aid in the development of professional development for counselors to better guide students and generate interest in STEM careers; Develop a list of available STEM Initiatives funding sources for state, district, and school use; Recommend a preparatory course of study for potential STEM degree majors; Research and compile a list of successful STEM practices and programs in other state, regions, and areas that can be replicated in Delaware.

Report Highlights & Recommendations

In 2011, the Committee developed a definition of STEM education and began to establish a status of STEM education in Delaware. Over several months, the committee researched efforts in other states that have very robust and successful STEM Initiatives in place to glean best practices, programs, and structures for a highly effective STEM initiative in Delaware.

In 2012, the Advisory Committee will:

- Recommend a STEM Coordinator position within the Department of Education that would work with the STEM Council, the STEM Business Network, higher education institutes, local districts, charter schools, and content specialists to further STEM initiatives throughout the state.
- Work with the Department of Education to revise the STEM plan and Race to the Top deliverables.
- Develop a competitive STEM Initiative implementation grant program to assist districts and charter schools in developing rich, successful STEM initiatives in Delaware schools.
- Work with community organizations to create a repository of STEM programs and opportunities for students, parents, and educators that occur outside classroom hours.

Program Evaluation & Monitoring

Committee Members

Sharon Densler, William Henry
Middle School Teacher

Ross Armbrrecht, Executive
Director of the Delaware
Foundation for Science and
Mathematics Education

Kristin Giffin, Director of Quality,
Agilent Technologies

Marian Wolak, Delaware
Department of Education

Adjunct Members
Phyllis Buchanan, Karen
Hutchison, Donna Johnson, Tonyea
Mead, Portia Yarborough

Committee Objectives

Research and evaluate existing STEM programs being implemented in local education agencies; Identify resources in our state and nationally that are available to support STEM literacy for all students; Collaborate and cooperate with other STEM Committee Members to research and evaluate STEM programs to implement throughout the state.

Report Highlights & Recommendations

In 2011, the Committee researched proven evaluation methods and programs in other states in order to recommend highly effective curricular programs that support STEM literacy in Delaware. This research will eventually lead to a comprehensive and frequently updated database of PK-12 offerings not only of specific STEM programs, but also of methods in which STEM skills may be aligned with existing science and math programs statewide.

In 2012, the Program Evaluation Committee will:

- Investigate how other states (such as Massachusetts and Maryland) use curricular program assessment tools to evaluate new and existing STEM programs and make recommendations for programs based on these evaluations.
- Evaluate and monitor math, science, and career technical education programs to identify STEM connections.
- Create a STEM database that catalogs and recommends highly effective STEM programs that occur within classroom hours.

Higher Education

Committee Objectives

Collaborate with institutions of higher education in Delaware on college-readiness standards for students seeking to pursue STEM educational pathways; Work with the Department of Education, school districts, and charter schools on strategies to increase the number of students who are college-ready in STEM fields.

Report Highlights & Recommendations

Higher education is an integral part of an effective STEM program through its education of future STEM professionals, induction of future STEM teachers, and investment in STEM-related research that draws federal grant funding to spark innovation that leads to growth for local businesses. In 2011, the Higher Education Committee worked with Delaware's Institutes of Higher Education to identify opportunities for improvement in each of these areas.



In 2012, the Higher Education Committee will:

- Provide students, parents, teachers and others involved with PK-20 education clear guidelines on the academic requirements for a student to be “STEM prepared” for an Institute of Higher Education in Delaware.
- Document, monitor and communicate students’ retention, graduation, and success in STEM programs at Delaware’s Institutes of Higher Education through the creation of a database to be shared with local school districts and the Department of Education.
- Encourage Delaware’s Institutes of Higher Education to mentor and provide internship opportunities to secondary STEM students.

All Committee reports are available in their entirety at www.stem.delaware.gov

Committee Reports

Committee Members

Dr. Kathryn Scantlebury, Professor of Chemistry & Biochemistry and Director of Secondary Education at the University of Delaware

Dr. Randy Guschl, Director of the Center for Collaborative Research and Education, Dupont

Dr. Doug Hicks, Department Chair of Engineering Technologies, Delaware Technical and Community College

Dr. Michelle Kutch, Supervisor of Curriculum and Instruction at the Brandywine School District

Dr. Nouredine Melikechi, Professor and Dean of the College of Mathematics, Natural Sciences and Technology and Vice President for Research at Delaware State University

Timeline for Goals & Accomplishments



1st ANNUAL REPORT

MARCH 2012

JUNE

SEPTEMBER

- ♦ Launch Delaware STEM website
- ♦ Devise ongoing list of funding resources for STEM initiatives
- ♦ Research and initiate professional development around STEM programs
- ♦ Develop list of STEM contacts within all schools

- ♦ Collect and analyze STEM AP data
- ♦ Initiate, disseminate, and analyze 2nd survey: What is o
- ♦ Recommendations based on best practice STEM progr
- ♦ STEM Institute for teacher training launched

- ♦ Identify STEM connections within Math and Science Coalitions and career technical education programs
- ♦ Establish database of highly effective nationally practiced STEM programs
- ♦ Establish and launch Delaware Business STEM Network
- ♦ Devise, disseminate, and analyze 1st business survey to determine career skills required
- ♦ Revise STEM plan and Race To The Top deliverables
- ♦ STEM Connector set up on website to emphasize career opportunities

- ♦ "Optimum" college-readiness standards defined
- ♦ STEM mentorships and internships created for 100 mic
- ♦ Compile inventory of STEM organizations outside PK-
- ♦ Catalogue of existing STEM programs published

2nd ANNUAL REPORT

DECEMBER

MARCH 2013

currently being offered statewide
ams and evaluation tools published

- ♦ Create Delaware STEM Speakers Bureau
- ♦ Implement STEM role model partnering plan
- ♦ Document 1st year college students' Math and English knowledge
- ♦ Create district/charter link on STEM webpage
- ♦ Create STEM newsletter
- ♦ Initiate quarterly best practice roundtable discussions with districts
- ♦ Develop RFP for district STEM grant initiatives
- ♦ Assign a STEM Coordinator position at the Department of Education
- ♦ Create STEM Education Support Zones with parents for each school

- ♦ Develop coursework framework to fulfill potential workforce needs
- ♦ Marry STEM course guidelines w/DOE requirements for 21st Century Skills
- ♦ Professional development units for STEM training and workshops completed
- ♦ Develop STEM awards/scholarships for successful teachers and students
- ♦ Provide mentoring workshops for STEM professionals

iddle and high school students
-12 school day



STEM Council

THERESA ANGELUS

Theresa Angelus received a Bachelors in General Science from Rutgers University and is currently pursuing a masters degree in curriculum and instruction with an emphasis on STEM related programs. Ms. Angelus is currently teaching the exploratory STEM program Gateway to Technology from Project Lead The Way at MOT Charter School and has been a teacher trainer for Enterprise for Education facilitating trainings in China and throughout the US for an issues based air quality curriculum.

DR. F. M. ROSS ARMBRECHT

Dr. Ross Armbrrecht has served as Executive Director of the DE Foundation for Science and Mathematics Education (DFSME) since spring 2005. He earned his B.S. in Chemistry from Duke University and his Ph.D. from the Massachusetts Institute of Technology. Joining DuPont in 1968 as a Research Chemist, he later served in various technical and management positions. He was president of the Industrial Research Institute, a gathering of top R&D leaders of major companies to improve innovation.

DR. SUSAN BUNTING

Dr. Susan Bunting became superintendent of the Indian River School District in southeastern Delaware in 2006 after teaching language arts, developing and implementing the district's gifted program, and serving as the district's Director of Instruction. She earned her B.S. in Psychology and Elementary Education from The American University, a M.Ed. from Salisbury University, and a Doctorate in Education Leadership from the University of Delaware.

DAVE CADOGAN

Dave Cadogan is the Engineering Manager at ILC, Dover, and has been with the company since 1986. He has a Bachelors of Science in Aeronautical Engineering from Western Michigan University, and is an Associate Fellow with the American Institute for Aeronautics and Astronautics. He has worked on numerous industry and government development teams to produce NASA's space suits, airships/zeppelins, spacecraft structures, and protective equipment for the military.

ANDREA CONNALLY

Andrea Connally has been a middle school educator for over 10 years teaching English, Social Studies, Math and Science. She is currently a 7th grade special education teacher for math and science, as well as the Science Department Chair at Alfred G. Waters Middle School in the Appoquinimink School District.

DAN CRUCE, ESQ

As the DOE's Deputy Secretary and Chief of Staff, Dan Cruce oversees day-to-day operations of the 260-person department, is the state's Race to the Top project lead, and chairs the department's Directors Council and Charter School Accountability Committee. The DOE's Charter School Office reports directly to Dan as does the District/Charter support work.

SHARON DENSLE

Sharon Densler was an Agriculture Education major in college and did her student teaching in agriculture at Lake Forest High School, eventually earning her Master's Degree in Animal Science and Biochemistry. She is currently the K-12 Science Specialist in the Capital School District.

KRISTIN GIFFIN

As a Director of Quality for Agilent Technologies, Kristin Giffin is responsible for Quality and Product Compliance globally for the Chemical Analysis business. She has been with Agilent for 20 years in a variety of engineering and management roles. She holds a Bachelor of Science Degree in Engineering from Cornell University.

PRATYUSHA GUPTA

Pratyusha Gupta is currently a senior at Caesar Rodney High School. She currently serves as the National President of the Technology Student Association (TSA), along with serving on TSA's Board of Directors. She has won numerous competitive awards in technology and engineering and plans to attend the University of Pennsylvania, double majoring in Business Finance and Materials Science Engineering.

DR. RANDOLPH GUSCHL

Dr. Randy Guschl joined DuPont as a research chemist in 1973, after receiving a Ph.D in Inorganic Chemistry from the University of Illinois. In 1993 he was named Director of Corporate Technology Transfer, and in 1999 assumed responsibility for DuPont's Office of Education. In 2000, he was named Director of the Center for Collaborative Research and Education, with global responsibilities for corporate collaborative research and support of education programs and funding at universities and government laboratories.

DR. DOUG HICKS

Dr. Doug Hicks has served as Department Chair for Engineering Technologies at Delaware Technical Community College - Owens Campus since 1997. In 1991 he co-founded a start-up company, CHPT Inc., to commercialize several patented technologies including a line of high pressure composite pumps used in military and domestic water purification systems internationally. Dr. Hicks serves on the board of directors of the Delaware Manufacturing Extension Partnership and the advisory boards for several high school technology programs. He received his BS in physical oceanography from Cook College/Rutgers University in 1977 and his MS and PhD in applied ocean science from the University of Delaware in 1980 and 1985, respectively.

DONNA JOHNSON

Donna Johnson is currently the Executive Director of the State Board of Education in Delaware. She served as the STEM Coordinator for Caroline County Public Schools in Maryland, the Math Coordinator of Curriculum and Instruction in Caroline County for five years, and taught high school mathematics for 10 years in Delaware. Her degree background includes bachelor's level study in Mathematics at Wake Forest University, a Mathematics Education major at DSU, and graduate classes in educational leadership and curriculum development from University of Delaware and Wilmington University.

SENATOR EDWARD KAUFMAN

Ted Kaufman is a former United States Senator from Delaware and the current Co-Chair of the Delaware STEM Council. As the Senate's only member to have worked as an engineer, Ted was especially active in promoting the expansion of science, technology, engineering and mathematics education. He graduated from Duke University with a BS in mechanical engineering. He later earned an MBA from the Wharton School of the University of Pennsylvania.

THERESA VENDRZYK KOUGH

Theresa Kough is currently the Director for Title I and Career Technical Resources within the College and Workforce Readiness Branch of the DOE. She holds a Masters of Library and Informational Science degree from Drexel University. Theresa has worked with the Curriculum Development and School Improvement work groups and participated in the Career and Technical Education reform initiative *High Schools That Work* as part of the New Castle County Vocation and Technical School District.

DR. MICHELLE KUTCH

Dr. Michelle Kutch is currently the Supervisor of Curriculum and Instruction for the Brandywine School District. She earned her BS in Biology and MI in Education from the University of Delaware, and Doctorate in Education Leadership at Wilmington University. She has developed curriculum for the University of Delaware, State of Delaware and districts, and has served on the State Standards Committee for Science.

DR. NOUREDDINE MELIKECHI

Dr. Nouredine Melikechi is a professor of Physics at Delaware State University where he has been since 2002. He was born in Algeria where he graduated with a Diplôme d'Etudes Supérieures in Physics from the University of Sciences and Technology. He went on to the University of Sussex in England to pursue graduate work in the area of Atomic, Molecular and Optical Physics and received a Master of Sciences in 1982 and a Doctorate of Philosophy in Physics in 1987.

DR. ANNIE NORMAN

Dr. Annie Norman has been State Librarian and Director of the Delaware Division of Libraries since 2002. Annie received her Doctorate of Education in Innovation and Organizational Leadership from Wilmington University, and is the recipient of the Audrey K. Doberstein Award for Leadership. She holds a Master's degree in Library Science from Drexel University and is a member of Beta Phi Mu, the international library and information studies honor society.

RENEE PARSLEY

Renee Parsley is the Math Content Specialist at Sussex Technical High School and holds National Board Certification in AYA Mathematics. She earned her BA in Mathematics from St. Vincent College and her MS in Physics Teaching from DSU. Her role at Sussex Tech requires sharing her time between teaching and leading the math department, as well as providing math support for integrating mathematics into other academic and Career and Technical Education (CTE) areas. She is also an adjunct instructor at DTCC, Georgetown.

CHERYL POTOCKI

Cheryl Potocki teaches at the Charter School of Wilmington where she has won The Presidential Award for Excellence in Math and Science Teaching and the USA All American Teaching Team Award. She is a graduate of Drexel University and a former electrical engineer who worked in the field for 5 years designing digital circuit boards and integrated circuits. She has been a teacher of mathematics for the past 19 years earning a Master's Degree from Villanova University in Secondary Education.

GEORGE REISSIG

George Reissig is the founder, president and CEO of Pixstar, Inc., headquartered in Lewes, DE. Pixstar is an IT consulting firm that provides a wide range of services to both government and commercial clients. George is a veteran of three start-up companies and has over 20 years of experience in information architecture, business intelligence, corporate management, and government contracting. He has extensive experience as a curriculum developer and trainer for users of business intelligence software applications.

DIANA ROSCOE

Diana Roscoe is the K12 math specialist for Southern Delaware Professional Development Center. She received her degree in Mathematics and Science Education from New Mexico State University and her graduate degree in Educational Leadership from the University of Delaware. She has been a classroom instructor for over 20 years in three states, spanning grades 6-12, teaching mathematics and biology. After teaching for Caesar Rodney, Woodbridge, and Polytech School Districts, she worked for two years on the Delaware state assessment as a teacher on loan with the Delaware Department of Education Assessment group.

DR. KATHRYN SCANTLEBURY

Dr. Kathryn Scantlebury is a professor in the Department of Chemistry and Biochemistry at the University of Delaware, Director of Secondary Education, and Coordinator for Secondary Science Education in the College of Arts and Sciences. She taught high school chemistry, science and mathematics in Australia before completing her doctorate at Purdue University. Dr. Scantlebury is a Fellow of the American Association of the Advancement of Science (AAAS), and serves on the Board of National Science Teachers Association as the Research Director.

SECRETARY JAMES H. SILLS, III

James H. Sills, III has over 28 years of banking and technology management experience. His background includes a combination of executive experience within large-scale banking operations, community banks, and government organizations. Mr. Sills was appointed by Governor Jack Markell as the Secretary and Chief Information Officer (CIO) for the State of Delaware, Department of Technology and Information, in January 2009. Mr. Sills earned a Bachelors Degree from Moorehouse College in Atlanta and an MPA from the University of Pittsburgh.

JOHN SINGER

John Singer is a STEM Technology Instructor and Department Chair in the Brandywine School District. He holds a Bachelors Degree from Rowan University, and a Masters Degree in Education from Wilmington University. He is the recipient of the Delaware Technology Education Teacher of the Year in 1996 and 2007, and is the recipient of the Delaware 2002 and 2011 Technology Education Program of the Year award.

STEVEN VANDERLOO

Steven Vanderloo is currently a senior at Concord High School. He was elected to State Treasurer, Vice President, and President of Delaware Technology Student Association, and is currently serving as their reporter. He has won numerous achievement awards for his leadership, service and technical skills and plans to major in Computer Engineering next year in college.

JUDSON WAGNER

Jud Wagner is currently the STEM Program Manager for the Brandywine School District and Co-Chair of the Delaware STEM Council. He was a Physics teacher for 15 years at Concord High School, as well as Science Department Chair for eight years. Jud earned a Bachelor of Science degree in Physics from Elizabethtown College and a Masters of Education in Instructional Technology from Wilmington College. He is a National Board Certified Teacher (NBCT) and has been recognized with the Presidential Award for Excellence in Math and Science Teaching (PAEMST).

MARIAN WOLAK

Marian Wolak has been an educator in the State of Delaware for 34 years and has been the Director of Curriculum, Instruction, and Professional Development for the DOE for the past 18 months. She was a 7 year principal at South Dover Elementary School, won the National Distinguished Elementary Principal 2010 Award for Delaware, and the Paul Carlson Leadership Award from the Delaware Principal's Academy.

DR. DEBORAH H. ZYCH

Dr. Deborah Zych began serving as Superintendent of Delaware's POLYTECH School District in August, 2011, having formerly served as Assistant Superintendent of the New Castle County Vocational Technical School District. She also held positions at the DOE and has 22 years of teaching and administrative experience in Maryland. She earned her BS from Towson State University, MS from Johns Hopkins University, and a Doctorate in Educational Leadership from Wilmington University.

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